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SOLID STATE MICROWAVE OVEN

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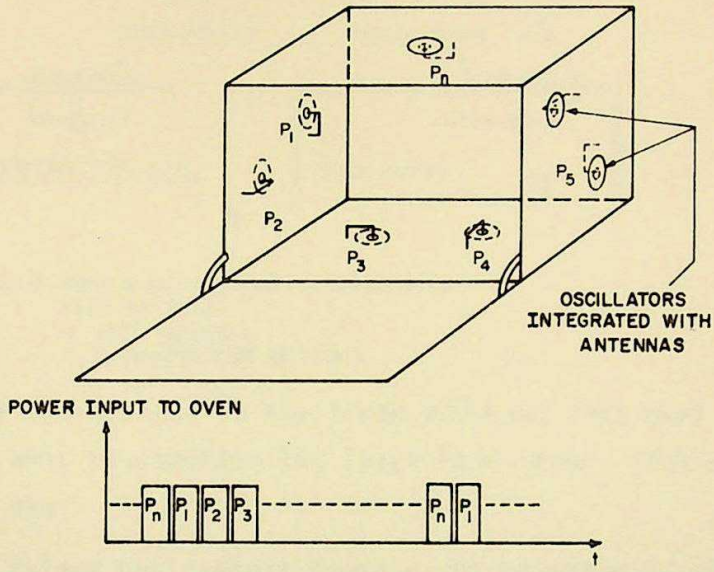
FIG. 1 SEQUENTIALLY DRIVEN PULSED OSCILLATORS AS POWER SOURCE FOR MICROWAVE OVEN.



Present microwave ovens for home food processing are generally powered by microwave tubes, i.e., magnetron, triode, etc., and rely on mode stirrers or similar means to reduce the heating non-uniformity which may result from standing waves in the oven cavity.

In the disclosed system the tube is replaced by a number of solid state bulk-effect oscillators which are coupled separately to the oven cavity. Aside from the long range advantages of lower cost and better reliability, as compared to tubes, the proposed system is also expected to provide a substantial improvement in heating uniformity.

To achieve the necessary power level of approximately 1 kW cw a number of pulsed oscillators, sequentially switched by SCRs is proposed. (See Figure 1.) The operating frequency is chosen preferably at the higher FCC-band (2450 MHz) which permits better matching to various oven loads and provides a better field uniformity due to the higher mode density in the cavity.

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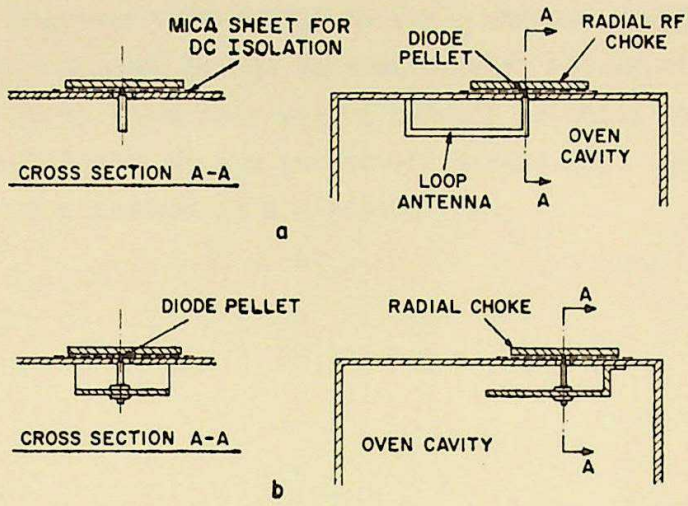

FIG.2 GUNN DIODE OSCILLATOR INTEGRATED WITH ANTENNA.
a. LOOP ANTENNA
b. U-SHAPED SLOT ANTENNA

A second set of oscillators at the lower FCC-band (915 MHz) can be included to improve the heat penetration for large food items. The main advantages of this system are:

1. Pulsed bulk-effect devices can be employed which generally have a higher efficiency than cw devices.
2. Interaction between oscillators is greatly reduced because only one or possibly two oscillators (if both FCC-bands at 915 and 2450 MHz are used) operate at the same time.
3. Heating uniformity is improved because oscillators are coupled at different points to the oven cavity, exciting different modes and irradiating different portions of the food.

Two possible forms of incorporating a Gunn diode directly into the antenna system of the oven are shown in Figures 2a and 2b. In both cases the antenna resonance is used as a frequency determining element for the oscillator; e.g., the loop antenna is designed for approximately $\frac{\lambda}{2}$ resonance to provide the proper impedance for the diode. DC power, sequentially switched by an SCR circuit, is fed to the diode via a radial choke plate that also acts as a heat sink. In Figure 2b the U-shaped slot formed by the

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plate and the cavity wall acts as the $\frac{\lambda}{2}$ antenna opening. The reactance of a Gunn diode presented to the antenna circuit varies widely between the on and off state which leads to a strong circuit detuning and consequently keeps the rf power losses in the turned-off diodes low. The interaction between diodes is thus reduced to a minimum.